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22242 7590 02/25/2009

FITCH EVEN TABIN AND FLANNERY
120 SOUTH LASALLE STREET
SUITE 1600
CHICAGO, IL 60603-3406

EXAMINER	
LIU, LI	
ART UNIT	PAPER NUMBER
2613	

DATE MAILED: 02/25/2009

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/535,526	05/18/2005	Hirotaka Nakamura	6700-85369	9340

TITLE OF INVENTION: OPTICAL WAVELENGTH MULTIPLEX ACCESS SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	05/26/2009

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

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nonprovisional	NO	$1510	$300	$0	$1810	05/26/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
LIU, LI	2613	398-072000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 599 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 599 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	10/535,526	NAKAMURA ET AL.	
	Examiner	Art Unit	
	LI LIU	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *1/23/2009*.

2. ☒ The allowed claim(s) is/are *1,3,4,8,13,19 and 25-45; renumbered as 1-27*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Kenneth N Vanderpuye/
Supervisory Patent Examiner, Art Unit 2613

DETAILED ACTION

Allowable Subject Matter

1. The following is an examiner's statement of reasons for allowance:

Claims 1, 3, 4 and 8 are allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system, comprising a center node (OSU) and n optical network units (ONUs) arranged by using a W-MULDEM unit, a multiplexing section between the OSU and the W- MULDEM unit established by extending a current-use optical fiber and a redundant optical fiber and access sections between the W-MULDEM unit and the individual ONUs established by the extension of optical fibers, wherein downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across the multiplexing section, and wherein the W-MULDEM unit performs wavelength multiplexing or wavelength demultiplexing for the upstream or downstream optical signals to provide bidirectional transmission, the OSU includes: a transmission device for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to the ONUs and transmitted to the ONUs along the current-use optical fiber, for multiplexing downstream optical signals having wavelengths $\lambda d1+\Delta\lambda$ to $\lambda dn+\Delta\lambda$ that correspond to the ONUs and transmitted to the ONUs along the redundant optical fiber, and for selecting either the current-use optical fiber or the redundant optical fiber for transmission, and a reception device for receiving upstream optical signals having wavelengths $\lambda u1$ to λun along the current-use optical fiber or for receiving

upstream optical signals having wavelengths λu1+ Δλ to λun+ Δλ along the redundant optical fiber; the individual ONUs receive corresponding downstream optical signals having wavelengths λd1 to λdn or corresponding downstream optical signals having wavelengths λd1+ Δλ to λdn+ Δλ, which are received along the optical fibers extended across the access sections, the individual ONUs transmit, to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths λu1 to λun and transmitted along the current-use optical fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λu1+ Δλ to λun+ Δλ and transmitted along the redundant optical fiber; the W-MULDEM unit includes an array waveguide diffraction grating (AWG) having two ports, respectively connected to the current-use optical fiber and the redundant optical fiber, and n ports, connected to optical fibers corresponding to the ONUs; the W-MULDEM unit demultiplexes to the ports corresponding to the ONUs the downstream optical signals that have wavelengths λd1 to λdn and are received along the current-use optical fiber, or the downstream optical signals that have wavelengths λd1+ Δλ to λdn+ Δλ and are received along the redundant optical fiber, or multiplexes, to the port corresponding to the current-use optical fiber or the redundant optical fiber, the upstream optical signals that have wavelengths λu1 to λun or wavelengths λu1+ Δλ to λun+ Δλ and that are received along the optical fibers corresponding to the ONUs; a wavelength difference between the downstream optical signal and the upstream optical signal corresponding to each of the ONUs is integer times a free spectrum range (FSR) of the AWG; the two ports of the AWG are provided at locations consonant with a

wavelength difference ($\Delta\lambda$) between optical signals transmitted along the current-use optical fiber and optical signals transmitted along the redundant optical fiber corresponding to each of the ONUsl and wherein the transmission device includes: a switching device for changing from a current-use optical fiber to a redundant optical fiber; a supervisory light source for outputting current-use fiber supervisory light and reserve fiber supervisory light having wavelengths $\lambda s0$ and $\lambda s1$ that differ from the wavelengths of the upstream optical signals and the downstream optical signals; a supervisory control unit, for detecting the supervisory light having wavelengths $\lambda s0$ and $\lambda s1$ that is received along the current-use optical fiber and the redundant optical fiber, and outputting a selection signal to the switching device to change from the current-use optical fiber to the redundant optical fiber; a multiplexing unit, for multiplexing the current-use fiber supervisory light having wavelength $\lambda s0$ and an optical signal transmitted along the current-use optical fiber; a demultiplexing unit, for demultiplexing the current-use fiber supervisory light having wavelength $\lambda s0$ from an optical signal transmitted along the current-use optical fiber; a multiplexing unit, for multiplexing the reserve fiber supervisory light having wavelength $\lambda s1$ and an optical signal transmitted along the redundant optical fiber; and a demultiplexing unit, for demultiplexing the reserve fiber supervisory light having wavelength $\lambda s1$ from an optical signal transmitted along the redundant optical fiber.

Claims 13, 19 and 29-39 are allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system whereby a center node (OSU) and n optical network units (ONUs) are arranged through

a W-MULDEM unit, whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a current-use downstream optical fiber, a current-use upstream optical fiber, a reserve downstream optical fiber and a reserve upstream optical fiber and access sections between the W-MULDEM unit and the individual ONUs are established by extension of downstream optical fibers and of upstream optical fibers, whereby downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed, using wavelengths that are allocated to the individual ONUs, and resultant optical signals are transmitted across the multiplexing section, and whereby the W-MULDEM unit performs either wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission, wherein the OSU includes: a transmission device for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to the ONUs and that are to be transmitted to the ONUs along the current-use downstream optical fiber, for multiplexing downstream optical signals having wavelengths $\lambda d1+\Delta\lambda d$ to $\lambda dn+\Delta\lambda d$ that correspond to the ONUs and that are to be transmitted to the ONUs along the reserve downstream optical fiber, and for selecting either the current-use downstream optical fiber or the reserve downstream optical fiber used for transmission, and receivers for receiving upstream optical signals having wavelengths $\lambda u1$ to λun transmitted along the current-use upstream optical fiber, or for receiving upstream optical signals having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$ transmitted along the reserve upstream optical fiber; the ONUs receive, along the optical fibers extended across the access sections, corresponding downstream

optical signals having wavelengths λd1 to λdn or corresponding downstream optical signals having wavelengths λd1+ Δλd to λdn+Δλd, the ONUs transmit, to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths λu1 to λun and that are to be transmitted along the current-use optical fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λu1+ Δλu to λun+Δλu and are to be transmitted along the redundant optical fiber; the W-MULDEM unit includes: a downstream array waveguide diffraction grating (downstream AWG) having two ports, which are to be respectively connected to the current-use downstream optical fiber and the reserve downstream optical fiber, and n ports, which are to be connected to optical fibers corresponding to the ONUs, and an upstream array waveguide diffraction grating (upstream AWG) having two ports, which are to be respectively connected to the current-use upstream optical fiber and the reserve upstream optical fiber, and n ports, which are connected to the optical fibers corresponding to the ONUs; the W-MULDEM unit demultiplexes to the ports of the downstream AWG that correspond to the ONUs the downstream optical signals that have wavelengths λd1 to λdn and are received along the current-use downstream optical fiber, or the downstream optical signals that have wavelengths λd1+ Δλd to λdn+Δλd and are received along the reserve downstream optical fiber, or multiplexes, to the port corresponding to the current-use upstream optical fiber or the reserve upstream optical fiber, the upstream optical signals that have wavelengths λu1 to λun or wavelengths λu1+ Δλu to λun+Δλu and that are transmitted to the upstream AWG along the optical fibers corresponding to the ONUs;

the two ports of the downstream AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda d$) between optical signals transmitted along the current-use downstream optical fiber and optical signals transmitted along the redundant downstream optical fiber corresponding to each of the ONUs and the two ports of the upstream AWG are provided at locations consonant with a wavelength difference ($\Delta\lambda u$) between optical signals transmitted along the current-use upstream optical fiber and optical signals transmitted along the redundant upstream optical fiber corresponding to each of the ONUs; and the transmission device includes: a switching device for changing from the upstream (or downstream) current-use optical fiber to the upstream (or downstream) redundant optical fiber, a supervisory light source for outputting a current-use fiber supervisory light and a reserve fiber supervisory light having wavelengths $\lambda s0$ and $\lambda s1$ that differ from wavelengths of the upstream optical signals and the downstream optical signals, a supervisory control unit, for detecting the supervisory lights having wavelengths $\lambda s0$ and $\lambda s1$ that are received along the upstream current-use fiber and the upstream reserve fiber, and for outputting a selection signal to the switching device to change from the upstream (or downstream) current-use fiber to the upstream (or downstream) reserve fiber, a multiplexing unit, for multiplexing the current-use fiber supervisory light having wavelength $\lambda s0$ and an optical signal transmitted along the downstream (or upstream) current-use optical fiber, a demultiplexing unit, for demultiplexing the current-use fiber supervisory light having wavelength $\lambda s0$ from an optical signal transmitted along the upstream (or downstream) current-use optical fiber, a multiplexing unit, for multiplexing the reserve fiber

supervisory light having wavelength λs1 and an optical signal transmitted along the downstream (or upstream) redundant optical fiber, and a demultiplexing unit, for demultiplexing the reserve fiber supervisory light having wavelength λs1 from an optical signal transmitted along the upstream (or downstream) redundant optical fiber; and the W-MULDEM unit includes: a demultiplexing unit, for demultiplexing the current-use optical fiber supervisory light having wavelength λs0, which has been multiplexed with the optical signal and has been received along the downstream (or upstream) current-use optical fiber, a multiplexing unit, for re-multiplexing the current-use optical fiber supervisory light having wavelength λs0 and an optical signal transmitted along the upstream (or downstream) current-use optical fiber, a demultiplexing unit, for demultiplexing the redundant optical fiber supervisory light having wavelength λs1 that has been multiplexed with an optical signal and received along the downstream (or upstream) redundant optical fiber, and a multiplexing unit, for re-multiplexing the redundant optical fiber supervisory light having wavelength λs1 and an optical signal transmitted along the upstream (or downstream) optical fiber.

Claims 25-28 are allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system whereby a center node (OSU) and n optical network units (ONUs) are arranged through a W-MULDEM unit, whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a current-use downstream optical fiber, a current-use upstream optical fiber, a reserve downstream optical fiber and a reserve upstream optical fiber and access sections between the W-MULDEM unit and the individual ONUs

are established by extension of downstream optical fibers and of upstream optical fibers, whereby downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed, using wavelengths that are allocated to the individual ONUs, and resultant optical signals are transmitted across the multiplexing section, and whereby the W-MULDEM unit performs either wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission, wherein the OSU includes: a transmission device for multiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn that correspond to the ONUs and that are to be transmitted to the ONUs along the current-use downstream optical fiber, for multiplexing downstream optical signals having wavelengths $\lambda d1+\Delta\lambda d$ to $\lambda dn+\Delta\lambda d$ that correspond to the ONUs and that are to be transmitted to the ONUs along the reserve downstream optical fiber, and for selecting either the current-use downstream optical fiber or the reserve downstream optical fiber used for transmission, and receivers for receiving upstream optical signals having wavelengths $\lambda u1$ to λun transmitted along the current-use upstream optical fiber, or for receiving upstream optical signals having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$ transmitted along the reserve upstream optical fiber; the ONUs receive, along the optical fibers extended across the access sections, corresponding downstream optical signals having wavelengths $\lambda d1$ to λdn or corresponding downstream optical signals having wavelengths $\lambda d1+\Delta\lambda d$ to $\lambda dn+\Delta\lambda d$, the ONUs transmit, to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths $\lambda u1$ to λun and that are to be transmitted along the current-use optical

fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λu1+ Δλu to λun+Δλu and are to be transmitted along the redundant optical fiber; the W-MULDEM unit includes: a downstream array waveguide diffraction grating (downstream AWG) having two ports, which are to be respectively connected to the current-use downstream optical fiber and the reserve downstream optical fiber, and n ports, which are to be connected to optical fibers corresponding to the ONUs, and an upstream array waveguide diffraction grating (upstream AWG) having two ports, which are to be respectively connected to the current-use upstream optical fiber and the reserve upstream optical fiber, and n ports, which are connected to the optical fibers corresponding to the ONUs; the W-MULDEM unit demultiplexes to the ports of the downstream AWG that correspond to the ONUs the downstream optical signals that have wavelengths λd1 to λdn and are received along the current-use downstream optical fiber, or the downstream optical signals that have wavelengths λd1+ Δλd to λdn+Δλd and are received along the reserve downstream optical fiber, or multiplexes, to the port corresponding to the current-use upstream optical fiber or the reserve upstream optical fiber, the upstream optical signals that have wavelengths λu1 to λun or wavelengths λu1+ Δλu to λun+Δλu and that are transmitted to the upstream AWG along the optical fibers corresponding to the ONUs; the two ports of the downstream AWG are provided at locations consonant with a wavelength difference (Δλd) between optical signals transmitted along the current-use downstream optical fiber and optical signals transmitted along the redundant downstream optical fiber corresponding to each of the ONUs and the two ports of the upstream AWG are

provided at locations consonant with a wavelength difference ($\Delta\lambda u$) between optical signals transmitted along the current-use upstream optical fiber and optical signals transmitted along the redundant upstream optical fiber corresponding to each of the ONUs; wherein the OSU further comprises: a device for oscillating optical carriers having wavelengths $\lambda u1$ to λun, which are used for upstream signals, so as to permit the ONUs to generate upstream optical signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream current-use optical fiber, and a device for oscillating optical carriers having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$, which are used for upstream signals, so as to permit the ONUs to generate upstream optical signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream redundant optical fiber; the W-MULDEM unit includes, in addition to the downstream AWG and the upstream AWG, two wavelength group demultiplex filters, for demultiplexing downstream optical signals having wavelengths $\lambda d1$ to λdn, which are received along the downstream current-use optical fiber from the optical carriers having wavelengths $\lambda u1$ to λun that are used for upstream signals, and for demultiplexing the downstream optical signals having wavelengths $\lambda d1+\Delta\lambda d$ to $\lambda dn+\Delta\lambda d$, which are received, along the downstream redundant optical fiber, from the optical carriers having wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$ that are used for upstream signals, an upstream signal optical carrier AWG, for routing the optical carriers having wavelengths $\lambda u1$ to λun, used for upstream signals, to ports corresponding to the ONUs, and n wavelength group coupling filters, for multiplexing the downstream optical signals that are sorted by the downstream AWG and the optical carriers, used for upstream signals, that are

sorted by the upstream signal optical carrier AWG, and transmitting the resultant signals to the downstream optical fibers that correspond to the ONUs; the ONUs are so constituted as to modulate corresponding optical carriers, used for upstream signals, from among those that are received while multiplexed with the downstream optical signals, and to transmit the obtained signals as upstream optical signals having wavelengths $\lambda u1$ to λun, or wavelengths $\lambda u1+\Delta\lambda u$ to $\lambda un+\Delta\lambda u$.

Claims 40 and 41 are allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system, whereby a center node (OSU) and n optical network units (ONUs) are arranged by using a W-MULDEM unit, whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a downstream current-use optical fiber, an upstream current-use optical fiber, a downstream redundant optical fiber and an upstream redundant optical fiber, and access sections between the W-MULDEM unit and the individual ONUs are established by the extension of downstream optical fibers and upstream optical fibers, whereby downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across the multiplexing section, and whereby the W-MULDEM unit performs wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission, the OSU includes transmission device for multiplexing downstream optical signals having wavelengths $\lambda dw1$ to λdwn that correspond to the ONUs and that are to be transmitted to the ONUs along the

downstream current-use optical fiber, for multiplexing downstream optical signals having wavelengths λdp1 to λdpn that correspond to the ONUs and that are to be transmitted to the ONUs along the downstream redundant optical fiber, and for selecting either the downstream current-use optical fiber or the downstream redundant optical fiber for use for transmission, and reception device for receiving upstream optical signals having wavelengths λuw1 to λuwn along the upstream current-use optical fiber or for receiving upstream optical signals having wavelengths λup1 to λupn along the upstream redundant optical fiber; the individual ONUs receive corresponding downstream optical signals having wavelengths λdw1 to λdwn or corresponding downstream optical signals having wavelengths λdp1 to λdpn, which are received along the optical fibers extended across the access sections, and transmit, to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths λuw1 to λuwn and are to be transmitted along the upstream current-use optical fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λup1 to λupn and are to be transmitted along the upstream redundant optical fiber; the W-MULDEM unit includes a downstream current-use demultiplexing unit corresponding to the downstream current-use optical fiber, and a downstream reserve demultiplexing unit corresponding to the downstream redundant optical fiber, n wavelength group coupling filters for multiplexing, for corresponding ports, downstream optical signals having wavelengths λdw1 to λdwn, which have been demultiplexed by the current-use demultiplexing unit, and downstream optical signals having wavelengths λdp1 to λdpn, which have been demultiplexed by the downstream reserve

demultiplexing unit, and for outputting obtained signals to the downstream optical fibers that correspond to the ONUs, an upstream current-use multiplexing unit corresponding to the upstream current-use optical fiber and an upstream reserve multiplexing unit corresponding to the upstream redundant optical fiber, and n wavelength group demultiplex filters, for dividing and transmitting, to corresponding ports of the upstream current-use multiplexing unit or the upstream reserve multiplexing unit, the upstream optical signals having wavelengths λuw1 to λuwn and having wavelengths λup1 to λupn, all of which are received from the upstream optical fibers corresponding to the ONUs; the downstream optical signals having wavelengths λdw1 to λdwn, which are received along the downstream current-use optical fiber, or the downstream optical signals having wavelengths λdp1 to λdpn, which are received along the downstream redundant optical fiber, are divided into ports corresponding to the ONUs; the upstream optical signals having wavelengths λuw1 to λuwn, or the upstream optical signals having wavelengths λup1 to λupn, which are received from the upstream optical fibers corresponding to the ONUs, are merged at the port that corresponds to the upstream current-use optical fiber or the upstream redundant optical fiber; and different bands are provided for the wavelengths λdw1 to λdwn of the downstream current-use optical signals and the wavelengths λuw1 to λuwn of the downstream reserve optical signals, and different bands are provided for the wavelengths λuw1 to λuwn of the upstream current-use optical signals and the wavelengths λup1 to λupn of the upstream reserve optical signals.

Claim 42 is allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system, whereby a center node (OSU) and n optical network units (ONUs) are arranged by using a W-MULDEM unit, whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a downstream current-use optical fiber, an upstream current-use optical fiber, a downstream redundant optical fiber and an upstream redundant optical fiber, and access sections between the W-MULDEM unit and the individual ONUs are established by the extension of downstream optical fibers and upstream optical fibers, whereby downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across the multiplexing section, and whereby the W-MULDEM unit performs wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission, wherein the OSU includes: transmission device for, when the ONUs are divided into two groups, #1 to #k and #k+1 to #n, and downstream optical signals are divided into two wavelength groups, λd1 to λdk and λdk+1 to λdn, multiplexing downstream optical signals having wavelengths λd1 to λdk so as to transmit downstream optical signals to the ONUs #1 to #k along the downstream current-use optical fiber, for multiplexing downstream optical signals having wavelengths λdk+1 to λdn for transmission along the downstream redundant optical fiber to the ONUs #1 to #k, for multiplexing downstream optical signals having wavelengths λdk+1 to λdn so as to transmit downstream optical signals to the ONUs

#k+1 to #n along the downstream current-use optical fiber, and for multiplexing downstream optical signals having wavelengths λd1 to λdk for transmission along the downstream redundant optical fiber to the ONUs #k+1 to #n, so that either the downstream current-use optical fiber or the downstream redundant optical fiber is selected for transmission, and reception device for, when upstream optical signals are divided into two wavelength groups, λu1 to λuk and λuk+1 to λun, receiving upstream optical signals, for which wavelengths λu1 to λuk for current use and wavelengths λuk+1 to λun for reserve use are allocated for the ONUs #1 to #k, and for which wavelengths λuk+1 to λun for current use and wavelengths λu1 to λuk for reserve use are allocated for the ONUs #k+1 to #n; the ONUs receive, along the downstream optical fibers at the access sections, downstream optical signals having corresponding wavelengths λd1 to λdk, or wavelengths λdk+1 to λdn, and transmit, to the upstream optical fibers, upstream optical signals having corresponding wavelengths λu1 to λuk when the upstream current-use optical fiber at the multiplexing section is employed for transmission, or transmit upstream optical signals having corresponding wavelengths λuk+1 to λun when the upstream redundant optical fiber is employed for transmission; the W-MULDEM unit includes: two ports to be connected to the downstream current-use optical fiber and the downstream redundant optical fiber, a downstream current-use demultiplexing unit corresponding to the downstream current-use optical fiber and a downstream reserve demultiplexing unit corresponding to the downstream redundant optical fiber, n wavelength group coupling filters, for multiplexing, for the individual ports, the downstream optical signals having wavelengths λd1 to λdk and λdk+1 to λdn, which

have been demultiplexed by the downstream current-use demultiplexing unit, and the downstream optical signals having wavelengths λdk+1 to λdn and λd1 to λdk, which have been demultiplexed by the downstream reserve demultiplexing unit, and for transmitting obtained signals to the upstream current-use optical fiber and the upstream redundant optical fiber, two ports to be connected to the upstream current-use optical fiber and the upstream redundant optical fiber, an upstream current-use multiplexing unit corresponding to the upstream current-use optical fiber and an upstream reserve multiplexing unit corresponding to the upstream redundant optical fiber, and n wavelength group demultiplex filters, for dividing the upstream optical signals having wavelengths λu1 to λuk and λuk+1 to λun and wavelengths λuk+1 to λun and λu1 to λuk, which are received along the upstream optical fiber corresponding to the ONUs, and outputting the signals to the corresponding ports of the upstream current-use multiplexing unit or the upstream reserve multiplexing unit; and the downstream optical signals having wavelengths λd1 to λdn, which are received along the downstream current-use optical fiber or the downstream redundant optical fiber, are divided among the ports corresponding to the ONUs, and the upstream optical signals having wavelengths λu1 to λun, which are received along the upstream optical fibers corresponding to the ONUs, are multiplexed at the port that corresponds to the upstream current-use optical fiber or the redundant optical fiber.

Claims 43-45 are allowed since the prior art of record does not teach or suggest in combination: an optical wavelength division multiplexing access system, whereby a center node (OSU) and n optical network units (ONUs) are arranged by using a W-

MULDEM unit, whereby a multiplexing section between the OSU and the W-MULDEM unit is established by extending a downstream current-use optical fiber, an upstream current-use optical fiber, a downstream redundant optical fiber and an upstream redundant optical fiber, and access sections between the W-MULDEM unit and the individual ONUs are established by the extension of downstream optical fibers and upstream optical fibers, whereby downstream optical signals from the OSU to the ONUs and upstream optical signals from the ONUs to the OSU are multiplexed using wavelengths that are allocated to individual ONUs and the resultant signals are transmitted across the multiplexing section, and whereby the W-MULDEM unit performs wavelength multiplexing or wavelength division for the upstream or downstream optical signals to provide bidirectional transmission, wherein the OSU includes: transmission device for multiplexing downstream optical signals having wavelengths λdw1 to λdwn that correspond to the ONUs and that are to be transmitted to the ONUs along the downstream current-use optical fiber, for multiplexing downstream optical signals having wavelengths λdp1 to λdpn that correspond to the ONUs and that are to be transmitted to the ONUs along the downstream redundant optical fiber, and for selecting either the downstream current-use optical fiber or the downstream redundant optical fiber for use for transmission, reception device for receiving upstream optical signals having wavelengths λuw1 to λuwn along the upstream current-use optical fiber or for receiving upstream optical signals having wavelengths λup1 to λupn along the upstream redundant optical fiber, device for oscillating optical carriers, having wavelengths λuw1 to λuwn, which are used by the ONUs for generation of upstream signals, and for

multiplexing the optical carriers and transmitting a resultant carrier to the downstream current-use optical fiber, and device for oscillating optical carriers, having wavelengths λup1 to λupn, which are used by the ONUs for generation of upstream signals, and for multiplexing the optical carriers and transmitting a resultant carrier to the downstream redundant optical fiber; the individual ONUs receive corresponding downstream optical signals having wavelengths λdw1 to λdwn or corresponding downstream optical signals having wavelengths λdp1 to λdpn, which are received along the optical fibers extended across the access sections, and transmit, to the optical fibers extended across the access sections, corresponding upstream optical signals that have wavelengths λuw1 to λuwn and are to be transmitted along the upstream current-use optical fiber extended across the multiplexing section, or corresponding upstream optical signals that have wavelengths λup1 to λupn and are to be transmitted along the upstream redundant optical fiber; the W-MULDEM unit includes a downstream array waveguide diffraction grating (downstream AWG), having two ports to be connected to the downstream current-use optical fiber and the downstream redundant optical fiber and n ports to be connected to the downstream optical fibers corresponding to the ONUs, an upstream array waveguide diffraction grating (upstream AWG), having two ports to be connected to the upstream current-use optical fiber and the upstream redundant optical fiber and n ports to be connected to the upstream optical fibers corresponding to the ONUs, two wavelength group demultiplex filters, for demultiplexing optical carriers having wavelengths λuw1 to λuwn, which are used for upstream signals, from downstream optical signals having wavelengths λdw1 to λdwn, which are received along the

downstream current-use optical fiber, and for demultiplexing optical carriers having wavelengths λup1 to λupn, which are used for upstream signals, from downstream optical signals having wavelengths λdp1 to λdpn, which are received along the downstream redundant optical fiber, an upstream signal optical carrier AWG, for dividing the optical carriers, which have wavelengths λuw1 to λuwn and are used for upstream signals, among the ports corresponding to the ONUs, and n wavelength group coupling filters, for multiplexing the downstream optical signals, which have been demultiplexed by the downstream AWG, and the optical carriers, used for upstream signals, which have been demultiplexed by the upstream signal optical carrier AWG, and for transmitting the resultant signals to the downstream optical fibers corresponding to the ONUs; the downstream optical signals having wavelengths λdw1 to λdwn, which are transmitted along the downstream current-use optical fiber to the downstream AWG, or the downstream optical signals having wavelengths λdp1 to λdpn, which are transmitted along the downstream redundant optical fiber, are divided among the ports corresponding to the ONUs; and the upstream optical signals having wavelengths λuw1 to λuwn or wavelengths λup1 to λupn, which are transmitted to the upstream AWG along the upstream current-use optical fibers corresponding to the ONUs, are merged at the port corresponding to the upstream current-use optical fiber or the upstream redundant optical fiber.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Monday-Friday, 8:30 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/L. L./
Examiner, Art Unit 2613
February 6, 2009

/Kenneth N Vanderpuye/
Supervisory Patent Examiner, Art Unit 2613